Future EU vehicle emissions regulations:
- Principles and requirements for real-world emissions –
- Status of on-going activities – committees –

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Outline

• Background
• Expectations of the legislators
• Existing regulatory elements
• Underlying principles for implementing real-world requirements
• Critical issues
• On-going efforts
Background

• **EU Air Quality Directives**
  - Persisting NO$_2$ exceedances in urban areas despite more stringent emissions standards
  - Main contributor is road transport, significant deviations between actual and expected NO$_x$ emissions

• **Strategy for climate and GHG emissions**

• **Long term vision for transport in Europe - 2011**
  **Transport White Paper:**
  - 60% CO$_2$ reduction over the 1990 levels by 2050
  - Halve the use of ‘conventionally fuelled’ cars in urban transport by 2030; phase them out in cities by 2050
Expectations of the legislators

- To have clean vehicles on the road and not only in the test cell

- To improve the ability to measure and quantify the real life emissions

- To push for an optimized design of emissions control technologies within the normal operating conditions

- To introduce cost-efficient regulatory tools, able to cope with the upcoming technologies and limiting the use of defeat devices/strategies
EURO VI 582/2011 & 64/2012: In-Service Conformity and type approval for heavy-duty engines, based on real-world vehicle testing with portable measuring equipment (PEMS)

- Verifies conformity of heavy-duty engines on vehicles during normal driving – at type approval and during their normal life (“In-Service”)

- Does not explicitly include to ‘real-world’ emissions requirements but provides a functional and performance check of the emissions control technologies
Underlying principles (1)

- Range of applicable normal vehicle operating conditions
  - Ambient temperature, atmospheric pressure
  - Vehicle/engine condition (cold/hot) and usage (e.g. speed, acceleration, engine power)

- Testing
  - Under real on-road driving conditions with Portable Emissions Measurement Systems (PEMS) as ‘golden’ method
Underlying principles (2)

• **Data evaluation rules**¹
  
  • Suitable averaging principles and statistics need to be developed due to variability of conditions within a test and longer test durations than for the conventional laboratory tests.

• **Not To Exceed principle**
  
  • Vehicle/engine need to comply within the range of predefined operating conditions

• **Decisions made from sound statistical methods and samples of vehicles/engines**
Critical issues

- Portable instrumentation for light-duty vehicles
  - Power consumption, size and weight acceptable for heavy-duty vehicles
  - Equipment needs to be smaller for light-duty vehicles

- Definition of boundary conditions in which the real-world requirements must be fulfilled

- Engine/vehicle development processes will become more challenging\(^1\)
On-going efforts (HDE)

- Heavy-Duty Engines
  
  *In-Service Conformity:*
  
  - Review of Euro VI PEMS In-Service Conformity procedures (practicability, implementation) by the end of 2014
  
  - PEMS PM Instrumentation evaluation exercise completed: instrumentation requirements proposed
  
  - PEMS PM Pilot Program (Industry run program)

  *Real Driving Emissions:*

  - Assessment of existing requirements to check whether they ensure that EURO VI+ engines are sufficiently clean. Attention paid to urban and low load operation.
On-going efforts (HDE PEMS PM)

- PEMS PM Instrumentation evaluation program
  - Total PM + Real-time sensor whose integrated signal is scaled by the total mass
  - Requirements proposed for gravimetric and real-time PM measurements
  - Instrumentation for gravimetric measurements (e.g. proportional dilution, sampling, filters) mostly aligned with existing laboratory standards
  - Real-time sensors key measurement performance is a particle penetration rate at a given particle size (e.g. limiting the influence of ultra-fine particles)
On-going efforts (LDV)

- Light-Duty Vehicles

  Real Driving Emissions (RDE):

  - Development of procedures (PEMS and laboratory random cycle) by the end of 2013.
  - Joint effort EU authorities and industry
  - Implementation for Euro 6 vehicles, calendar and implementation measures (e.g. sampling of vehicles, administrative aspects) not officially agreed.
On-going efforts (NRMM)

- Non-Road Mobile Machinery Engines
  
  *In-Service Conformity:*
  
  - Pilot Program (Industry run program) to be completed by the end of 2012
  - Implementation for Stage IV or V standards (under discussion)
  - Contributions from major EU and US engine manufacturers
  - Adaptation of heavy-duty procedures to NRMM
  - Equivalence with US methods being assessed
• Many thanks for your attention !!!
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